rubber; as a possible competitor of the natural variety its future appears hopeless. More plantation rubber is being produced than the world at present requires, or is likely to require for some time to come. At the same time, the investigations which have led to the synthesis of rubber, or of rubber-like substances, have great theoretical value, and have shed much light on the true nature and chemical constitution of this most remarkable substance.

Forward Progression.

Gaseous Exchange and Physiological Requirements for Level and Grade Walking. By Henry Monmouth Smith. (Publication No. 309.) Pp. viii + 310. (Washington: Carnegie Institution, 1922.) 6 dollars.

FORWARD progression, perhaps the form of muscular activity most commonly engaged in by the average human being, is, both in its anatomical and physiological aspects, one of extraordinary complexity. The work of Marey, Carlet, Braune and Fischer has thrown much light on the actual movement of the body and legs during the forward movement, and the researches of Zuntz and Schumburg, Durig, Douglas, Benedict and Murschhauser, and others have helped towards the elucidation of the metabolism and energy expenditure of the movement. A number of problems which have emerged from the previous investigations still remain unsolved; some of these questions are discussed, and in part elucidated, in this new volume from the Carnegie Institution's Nutrition Laboratory at Boston.

This book forms the natural sequel to the work of Benedict and Murschhauser. These workers dealt with the changes in the metabolism, the cost and the efficiency of the human body during horizontal walking. Monmouth Smith's work, although ostensibly it is meant to deal principally with "grade" walking, contains much new data on horizontal walking, more especially as regards the influence of the movement and change of position on the blood pressure, pulse and temperature. The effect of horizontal walking on the blood pressure is not great; as regards the pulse rate, one of the most striking features is the great variation found in the same subject under apparently identical conditions. In connexion with the rectal temperature several interesting facts emerge: (*a*) there is a definite lag in the rise of temperature which occurs in changing from standing to walking; (*b*) except at the higher rates the effect of the rate of walking is small; and (*c*) the maximum increase at any speed less than 100 metres per minute does not exceed 0·5° C. (without taking into consideration the duration of the exercise). Many new observations have also been made on the "step-lift." A slightly lower value for the cost of this operation than that of previous workers was found. A slightly lower value than that commonly accepted was also found for the energy cost per horizontal kilogrammetre.

In the grade-walking experiments a preliminary series of experiments were made on the influence of the mouthpiece on the breathing of the subject. These tests are of considerable technical interest. The general result is that unless the preliminary period of breathing with the mouthpiece in position be of sufficient duration, the accuracy of the determination of the respiratory quotient is endangered.

A large number of observations were also made on the influence of grade walking, in addition to the determination of the energy cost, on the blood pressure, pulse, pulmonary ventilation, and temperature. Those on the temperature are particularly interesting. It was found, for example, that the temperature increase was not always the same for the same amount of work, although, as might be expected, a higher temperature and a greater increase over normal were usually observed when the work and the metabolism were greatest. The maximum total increase, when the work done was heavy, was between 1·5° C. and 2° C. A number of very interesting experiments on the rate of the fall of the rectal temperature after the cessation of work are recorded. In one experiment at least it was very rapid, 1·14° C. in twelve minutes, or 0·09° C. per minute. On the other hand, if observations were continued, the rectal temperature was found to approximate normal pre-work temperature only about two hours after the cessation of work.

The Nature of Science.

What is Science? By Dr. Norman Campbell. Pp. ix+186. (London: Methuen and Co., Ltd., 1921.) 5*s*. net.

"WHAT is Science?" is a question that may be answered in as many ways as "What is Truth?", and much depends on the questioner. In this case the original questioner was apparently an audience drawn from the Workers' Educational Association. Fifty or more years ago the worker was all agog for science; now, it appears, he either shoulders it aside as too academic for practical use, or rejects it as the "stone" of vocational education proffered instead of the "bread" of culture. The worker, in this limited sense, is not alone in misapprehending what is meant by "science," for the public at large, as recent years have given abundant proof, often blames it for sins

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of both commission and omission, due really to human nature. It is well then that we should be provided in this handy form with a clearly-written and common-sense account of what scientific men mean by "science."

So much for the form of the answer. As for its content, Dr. Campbell will find one or other of his statements disagreed with by each philosopher in turn. But he refrains, wisely, from straying far along the perilous paths of metaphysics, and, while expressing his own opinion, admits frankly that there are others. If the question is to be answered by way of definition, Dr. Campbell's may be accepted as giving at any rate one point of view: "Science is the study of those judgments concerning which universal agreement can be obtained." In rebutting the objection that there cannot be universal agreement, Dr. Campbell selects as the most perfect example the order in which events occur. But have not some of the relativists suggested that agreement on this may not necessarily be universal?

Probably a definition is not the best way of answering the question. Dr. Campbell's definition may be true, but it does not cover the whole ground. It has one advantage, in that it omits reference to "the external world of nature," and that advantage is not merely metaphysical but practical, since without further discussion it permits one to include the study of the human mind and its products. It has been the attempt to define science by reference to its subject matter that has led to much of the misunderstanding. Science is, it seems to us, rather a way of looking at things or a method of study, and if it excludes any subject it is only because the method proves inapplicable. Undoubtedly a necessary condition is agreement upon the judgments. Take literature for example. Purely æsthetic criticism will never give that "Quod semper, quod ubique, quod ab omnibus" which science demands; and science therefore must decline to appraise the poetic merits of "Lear," "Hamlet," and "Macbeth." But the number of lines with weak endings in those plays can be ascertained definitely, and can therefore be subjected to scientific inquiry.

How science works is the subject of three chapters, which consider the nature, the discovery, and the explanation of the laws of science. We used to be taught that "a Natural Law is a regular sequence of Cause and Effect." Dr. Campbell discards the causal relation and replaces it by "invariable association." It is this invariability that lies at the base of the definition of science recently given by the Master of Balliol: "a body of generalisations from facts which enables us to predict fresh facts." But further inquiry shows that the associations, in their original sense, are not invariable. Exceptions arise and have to be met by new laws, either of the same kind or of a new type. The discovery of a new type of law is the privilege of genius. So far one may go with Dr. Campbell, but when he implies that the genius imposes the law in accordance with his "intellectual desires" and that "the universe obeys the dictates of [his] mind," it is not so easy to follow him. Does he mean that all our systems are purely subjective? To some extent the answer to this question is given in the section headed "Are theories real?" The reality of a theory depends on its power of predicting true laws, and thus it gains universal acceptance. "A molecule is as real, and real in the same way, as the gases the laws of which it explains. It is an idea essential to the intelligibility of the world not to one mind, but to all; it is an idea which nature as well as mankind accepts. That, I maintain, is the test and the very meaning of reality."

The position is intelligible, but our difficulties recur when we come to the interesting remarks on symbols and the æsthetic sense of the mathematician—"one more illustration of the power of pure thought, aiming only at the satisfaction of intellectual desires, to control the external world." Would it not be truer to say that the external world, by countless direct and indirect means, acting since life began, has so influenced the unconscious as well as the conscious perceptions of man, that the mind necessarily regards as harmonious those relations which conform to the seen or unseen reality of the universe? The scientific genius is he who has a deeper intuition of that harmony than his fellows, or, perhaps more accurately, he who can the most easily raise to the plane of consciousness the subconscious promptings of external nature.

Aspects of Military Medicine.

History of the Great War, based on Official Documents. Medical Services: Diseases of the War. Vol. 1. Edited by Major-General Sir W. G. MacPherson, Major-General Sir W. P. Herringham, Col. T. R. Elliott, and Lt.-Col. A. Balfour. Pp. viii + 550. (London: H.M.S.O., 1922.) 21*s*. net.

UP to the beginning of the nineteenth century the medical history of wars was very incomplete, and is to be found in memoirs or commentaries written by individual military surgeons. To this category belong the works of Percy, M'Grigor, and particularly Barron Larrey, the great military surgeon of the Napoleonic period. A great change, however, took place with the publication by the Americans of the splendid and exhaustive "Medical and Surgical History of the War of Rebellion (1861–1865)," which has remained a model for all later works on military medicine. After the greatest of all wars it was to be

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